

THORACIC SURGERY

THORACIC TRAUMA

- Trauma is a leading cause of death.
- Causes more deaths in children/adolescents than all diseases combined. "accounts for 50% of trauma deaths."

* Tri-modal distribution of death :-

① • immediate death :- (50%) $\frac{1}{2}$

- within seconds or minutes
- involve brain, spinal cord & great vessels.
- No thing to do, only prevention by education. "not job of Doctors"

② • early death :- (30-35%) $\frac{1}{3}$

- within 4-6 hrs "Golden hour" 3-4 hr.
- involve thoracic trauma, Liver/spleen & pelvic injuries. "bleeding"
- we can do ^{something as} optimum initial care to help pt $\rightarrow$ ABC reduce No. of death.

③ • Late death :- (15-20%) $\frac{1}{5}$

- within days to weeks.
- involve multiorgan dysfunction & sepsis.
- also optimum initial care. ~~with thrombolytics~~

NB :- about 15% of blunt trauma chest require surgery (thoracotomy) [85% need simple procedures]. ^{80% Toronto}

NB :- Injuries fall into 2 categories :-

① blunt :- (most common) :- motor vehicle collision (MVC)
fall, assault, sports.

② Penetrating :- ($\uparrow$ in incidence) :- gunshot, stabbing

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* Pathophysiology of chest trauma :-

- factors which kill pt of chest trauma are :-

① Hypoxia :-

- Due to rupture of great vessels → bleeding → shock causing ↓ O₂ perfusion to tissue.
- Or due to ^{& hemo} pneumothorax → lung compression → lung collapse → no gas exchange between alveoli and B.V → deoxygenated blood coming & out of lung, this is called "Ventilation-Perfusion mismatch"

② Hypercapnoea :-

- Due to ↑ CO₂ diffusion rate through the tissue to more than 200 times than O₂.
- hypercapnoea is caused by stop of respiration & change of air pressure.

③ Metabolic acidosis :-

- Due to bleeding → shock → ↓ O₂ perfusion to tissue, shifting of aerobic to anaerobic metabolism → ↑ lactic acid [acidosis].

NB :- management of thoracic trauma next need specialist surgeon (simple procedures usually). "lecture"

NB :- Ruptured diaphragm is more often diagnosed on Left side, as liver conceals Rt side defect. ^{Toronto}

NB :- High risk injuries include :-

- MVC "motor vehicle collision" at high speed → ejection from vehicle
- Motor-cycle collision.
- Fall from height > 12 ft (3.6 m).
- Vehicle vs. pedestrian crashes.

Management of thoracic trauma :-

I- Primary survey :- "resuscitation"

- used to save life, identify injury & immediate treatment.
- the resuscitation (1st survey) is the 1st step before the start of stopping the bleeding. (tension pneumothorax before bleeding)

A • Airway :- make sure airways are patent.

B • Breathing :- check respiratory rate, quality, chest movement

C • Circulation :- check circulation, pulse (2 large canula in 2 different limbs)
- after that do investigations

2- Secondary survey :- "definitive ttt"

- used to ↓ morbidity.
- take detailed history, examination, inve

* D/D of life threatening chest injuries :-

"HOT & FAT CHEST"

1. Hemothorax.
2. Open pneumothorax.
3. Tension pneumothorax.
4. Flail chest,
5. Airway obstruction.
6. Tamponade.
7. Contusion: pulmonary, cardiac
8. Hernia :- traumatic, diaphragmatic
9. ESophageal perforation.
10. Traumatic injury / Thoracic aorta rupture / Tracheobronchial disruption

NB :- Hemothorax, Tension pneumothorax, Tamponade & Thoracic aorta rupture are rapidly life threatening.
also flail chest!

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* Examination :-

⇒ After resuscitation, you should remove clothes to expose pt to see e.g. hole as in pneumothorax

• inspection :- ① for big hole, any wound, tyre mark, seat belt mark (last 2 indicate severe chest trauma) or major cardiac or vascular injury.

② check breathing if need intubation.

(if rate > 45 breaths/min $\rightarrow$ abnormal), Normal 12-18

(if quality shallow $\rightarrow$ abnormal).

⇒ in shallow breathing tidal volume < 500 ml

Tidal volume :- normally 500 ml (150 in dead space & 350 ml in alveoli)

so shallow breathing $\downarrow$ air in alveoli (150 fixed)

③ check neck veins $\rightarrow$ may be congested.

④ check tracheal $\rightarrow$ may be pushed.

• Palpation :- e.g. check pulse.

• Percussion :- e.g. Dull $\rightarrow$ hemothorax.

hyperresonant $\rightarrow$ pneumothorax.

• auscultation :- air entry both sides,

muffled heart sound $\rightarrow$ tamponade ^{cardiac}

⇒ Last to do :- connect pt to ECG to check if there is

PEA

$\rightarrow$ means no pulse but ECG impulse

$\downarrow$

Pulsless Electric Activity.

* assessment of trauma pt :-

A = Air way.

B = Breathing.

C = Circulation

D = Disability / Drug / DC shock _{adrenaline}

E = Exposure

2nd survey :- complete history & examination

- reassess vital signs

- full neuro exam. "Glasgow coma s."

- investigation.

TENSION PNEUMOTHORAX

- One way valve causing accumulation of air inside the pleural cavity, it causes mediastinal shift.

* Pathophysiology :-

- Small puncture in chest wall $\rightarrow$ air moves from high pressure (atmosphere) to low pressure (pleural cavity) and cannot return to outside [one way valve]. or internal valve by Bronchopleural fistula
- accumulation of air inside pleural cavity $\rightarrow$ lung will be compressed $\rightarrow$ lung collapse $\rightarrow$ hypoxia $\rightarrow$ shock.
- also compress great vessels of heart $\rightarrow$ kinked SVC & IVC which $\rightarrow$ $\downarrow$ VR to heart $\rightarrow$ $\downarrow$ CO $\rightarrow$ $\downarrow$ BP $\rightarrow$ Secondary cardiogenic shock.

NB: air enters pleura from chest wall or from lung, normally pleural cavity has -ve pressure -2 or -3 than atmosp.

NB:- not send pt to x-ray, CT or MRI unless pt respiration, circulation becomes stable.

Dx is clinical

Non-radiological Dx.

* Clinical Picture :-

$\uparrow$ depth & $\uparrow$ rate of respiration $\rightarrow$ $\uparrow$ pneumothorax.

- chest pain, air hunger, respiratory distress, $\uparrow$ HR, congested neck veins, cyanosis, asymmetry of chest wall motion, tracheal deviation away, distant heart sounds (dullness)
- hyperresonant ^{tympanic} percussion, unilateral absence of breath sounds.
- ECG shows PEA (no pulse).

deviated apex beat.
deviated trachea

NB:- Causes of PEA :- (Pulseless Electrical Activity)

- ① tension pneumothorax
- ② massive Haemothorax
- ③ cardiac tamponade.
- ④ hypoxia.

Treatment :-

needle thoracostomy :- large bore needle, 2nd I.C space midclavicular followed by chest tube in 5th IC space, anterior axillary line connect to underwater seal & send pt to x-ray.

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$\rightarrow$ just ant. to midaxillary line

OPEN PNEUMOTHORAX

* Pathophysiology :-

- Air entering chest wall from wound (big hole), at first air moves from high pressure (atmospheric air) to low pressure (pleural cavity) → then when pressure becomes equal, air in pleura moves outside → repeating cycle with inspiration & expiration → lung inflated & collapsed.

* Clinical Picture :-

- O/E :- Gunshot or other wound (hole $> 2/3$ tracheal diameter)
± exit wound.
 - unequal breath sounds.
 - hypoxia ↓ PO₂

* treatment :-

- Air-tight dressing sealed on 3 sides then connect chest tube with underwater seal & send to xray.

NB:- 3-way seal for open pneumothorax i.e. "sucking chest wound" allows air to escape during expiration (so no tension pneumothorax) but seals itself to allow adequate breaths during inspiration.

NB:- Pulsus paradoxus :- a drop ↓ in BP of >10 mm Hg with inspiration (Recall that BP normally ↓ & inspiration, but what's paradoxical about this is that it ↓ more than it should)

NB:- Primary spontaneous pneumothorax :-

- is a common disease seen in young people (75% male young)
from mid-teens to mid-20s, tall, runs in families
- Caused by leak from small blebs, vesicles or bullae
- recurrent as if occurs once, $1/3$ of pt recur
if occurs twice $1/5$ " " "

Bailey & Love

SIMPLE PNEUMOTHORAX

- Small amount of air enter pleural cavity not excess & not go out.

C/P - percussion → ~~not~~ resonant.

~~not serious~~ not serious you can send pt to x-ray.

ttt - chest tube with underwater seal → air bubbles for few days then disappear → after stop bubbles do clamp on tube & send pt to x-ray → if lung expanded well, no pneumothorax wait 24 hr (ē clamp) then re-xray pt → if no pneumoth. → remove chest tube
→ if there is still → may be a tracheo-pleural fistula

- NB tracheopleural fistula needs surgery closure. or may do bronchoscope.

HAEMOTHORAX

- accumulation of blood ~~in~~ in pleural cavity.

① mild haemothorax → blood < 500 ml

② Moderate " → " 500 - 1500 ml.

③ massive " → " > 1500 ml

- most common source of blood is intercostal arteries. other sources are:- internal thoracic artery (2nd commonest), hilar artery, great vessels, lung or from abdomen. (liver or spleen trauma - may → haemothorax so in case of trauma you have to check all body).

chest tube, if bleeding > 200 ml/hr for the next 4 hrs → indication for thoracotomy
so very imp. to know time of insertion of chest tube
or > 1500 cc total bd loss → thoracotomy.

- massive hemothorax clinically dull percussion, PAA, type II hypovolemic shock, lung collapse, tracheal deviation. Neck veins not congested "shock" (flat neck vein)

- ttt of massive hemothorax

- Auto perfusion of blood from bleeding $\rightarrow$ by taking blood from pleura by chest tube & return it to the pt, if no facilities give fluid until pt becomes ready to thoracotomy.

NB $\rightarrow$ Auto transfusion is better than blood transfusion.

CARDIAC TAMPONADE

* Definition :- accumulation of fluid in pericardium w interfere $\bar{e}$ cardiac filling $\rightarrow \downarrow V.R \rightarrow \downarrow B.P \rightarrow \downarrow C.O \rightarrow$ shock.

* Clinically :- congested neck veins, $\uparrow HR$, $\uparrow RR$, Pulsus Paradoxus

Beck's triad $\rightarrow$ hypotension
congested neck veins
muffled heart sounds.

(trachea not affected)

• Kussmaul's sign :- $\uparrow JVP \bar{e}$ inspiration.

* ttt :-

- pericardiocentesis :- insert long canula 1 inch below & to the lt of sternum with 45° angle, point canula direction into inferior scapula

- insert canula with ECG monitoring $\rightarrow$ if canula reach heart $\rightarrow$ ECG changes

- once blood comes out $\rightarrow$ pt improved.

- NB: if blood comes from heart $\rightarrow$ fast clot but from pericardium no clot formation

- leave catheter inside as blood may re accumulate & send pt to theater for thoracotomy.

SUBCUTANEOUS EMPHYSEMA

"SURGICAL EMPHYSEMA"

- = It is presence of air in the tissue "Baily & Love"
- = In fracture rib, tear in overlying soft tissue allows air to enter subcutaneous tissue.
- = The skin over trunk & neck and sometimes face gives a Peculiar crackling feel to examining fingers → crepitation.
- = In sever cases, face & neck may become grossly swollen.

NB:- surgical emphysema is a **Misleading** as it is rarely caused by surgeon.

* Causes :-

- ① = The most serious cause is rupture esophagus. *Baily & Love*
- ② = Mediastinal surgical emphysema can occur with asthma or ventilator barotrauma.
- ③ = A poorly managed chest drain.

FRACTURE RIB

- = Most common injury to the chest by direct trauma (blow).
- = the most common rib affected are 7th, 8th & 9th.
- = usually occur in mid-axillary line, more at angle of rib.

* **C/Picture** :- Pain w ↑ by respiration & cough
- limitation of respiration, infection

* **Diagnosis** :- clinically by bimanual examination
- Chest x-ray :- may be normal, repeat after 2 weeks → callus confirm Dx.
- Bone scan: more sensitive.

* **complication** :- Flail chest.

FLAIL CHEST

* Definition :-

- = fracture of at least 2 ribs and each rib has at least 2 fracture / or fracture in both sides of sternum.
- = or free-floating segment of chest wall due to > 2 rib fractures, each at 2 sites.

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* Clinically :-

- = Paradoxical movement of flail segment
- = palpable crepitus of ribs.
- = ↓ air entry on affected side.
- = shallow breathing & lung contusion

* Management :-

- = O₂ + fluid therapy + pain controls. "IPPV"
- = positive pressure ventilation ± intubation & ventilation
- = Usually pt w/ flail chest has severe trauma associated with other injuries → pt need fluid as may develop hypovolemic shock.

give colloid (not as hypovolemic shock crystalloid), colloid preferred as if give crystalloid risk of pulmonary edema.

- = Pain killer to ↓ shallow breathing by giving I.C. injecta block or thoracic epidural anaesthesia.
- = physiotherapy -
- = ABG at first done each hour then each 4 hrs due to artificial ventilation ^{that} pt needs.

NB:- flail chest may cause Respiratory failure type II due to failure of adequate expansion of affected side and bec. of shunting of deoxygenated air from lung on side of fracture to other side.

AORTIC INJURY

* Pathophysiology :-

- decelerating injury occurs as high velocity then sudden stop e.g car accident or fall down

NB :- 95% of aortic injury die immediately.

95% of " " occurs in isthmus of aorta
(near ligamentum arteriosum at subclavian) → _{toronto}

* Clinically :-

- H/o decelerating injury.
- chest pain, upper limb hypertension, lower limb hypotension
- weak pulse.
- wide mediastinum in x-ray.

* management :-

- Done by radiologist + surgeon by using x-ray & angio, shows aneurysm → do repair or graft